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Next Generation Networks

Notes from the Conference

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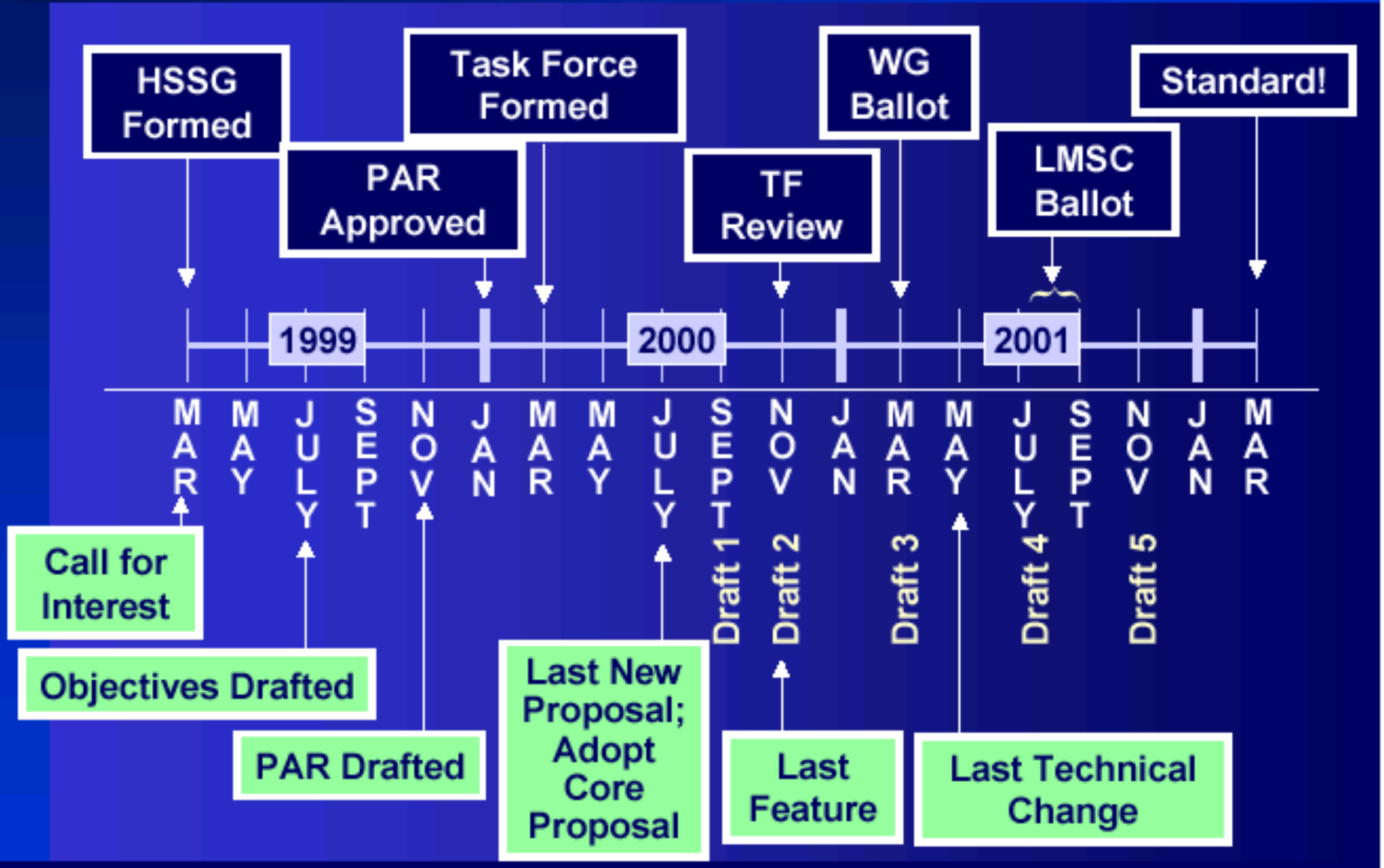
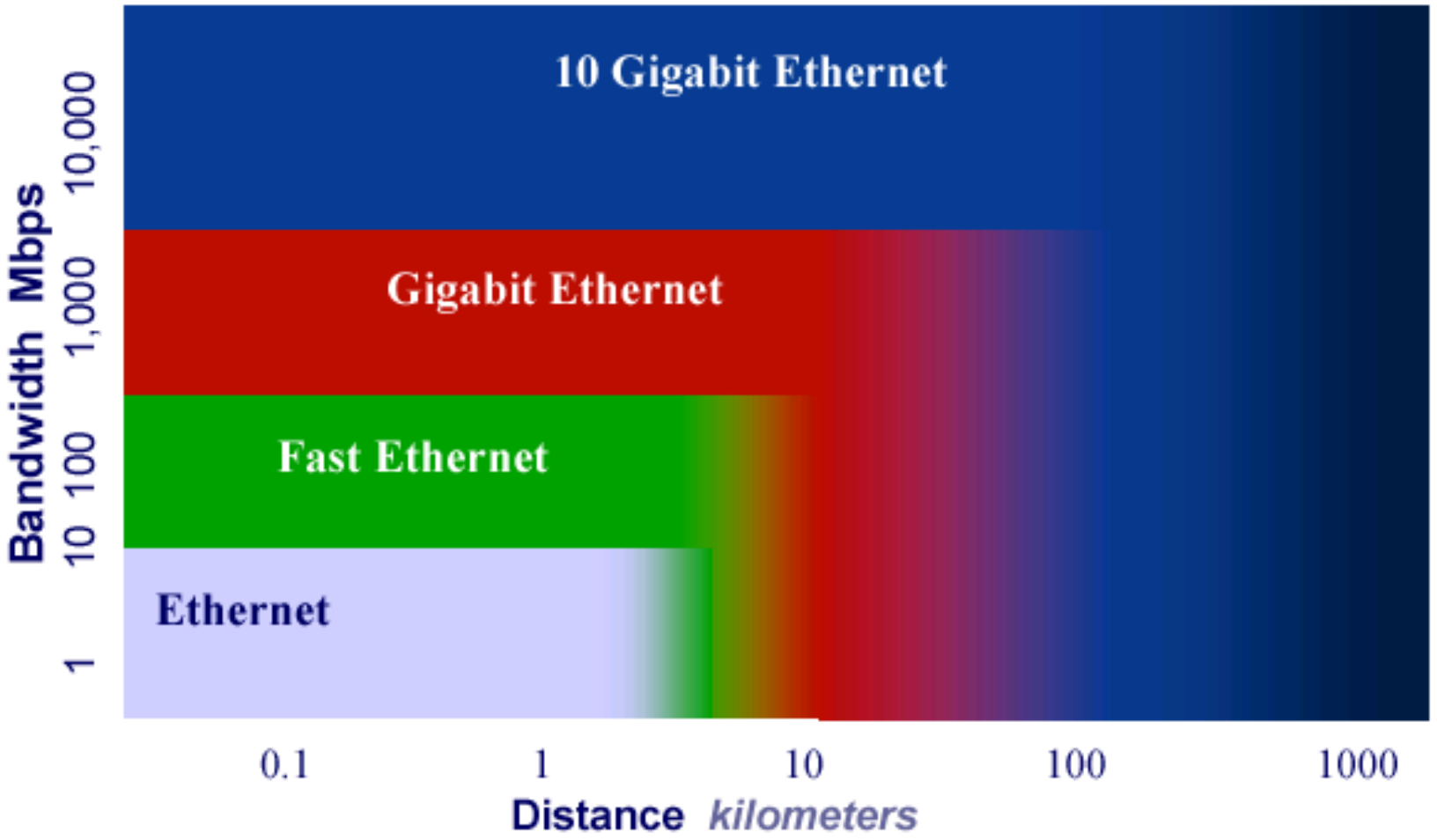
10 Gigabit Ethernet

- IEEE 802.3ae
  - SONET-friendly, not SONET-compliant
  - 10GbE over DWDM
    - Dark Fiber
    - Dark Wavelengths
  - Embedded BERT
  - Jumbo frames allowed but not required

IEEE P802.3ae Schedule



Bandwidth/Distance Evolution

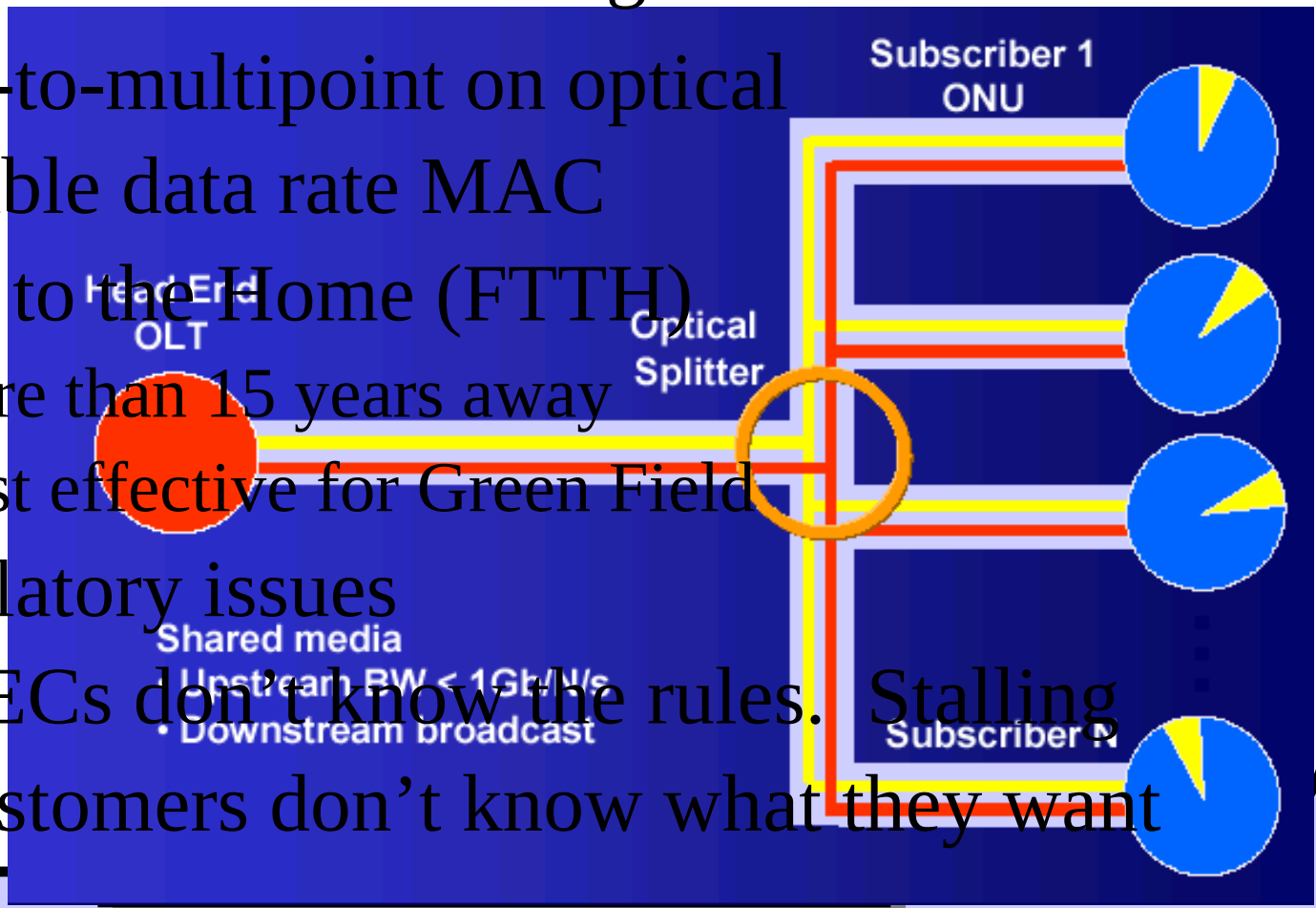


DTE Power - 802.3af

- Mid-2002
- Power over Ethernet for
  - IP Phone
  - Web cam
  - Wireless Access
  - Shaver

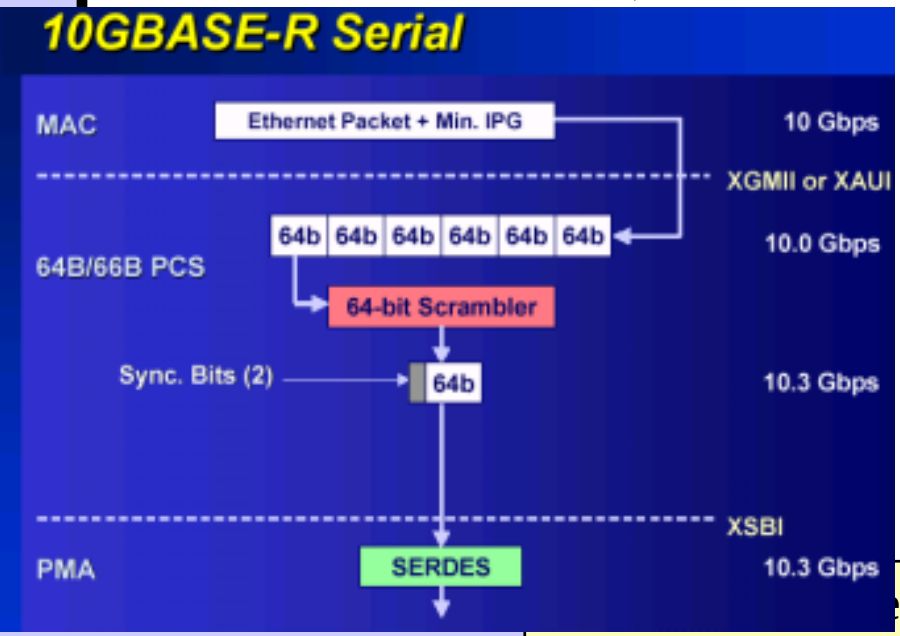
Ethernet in First Mile

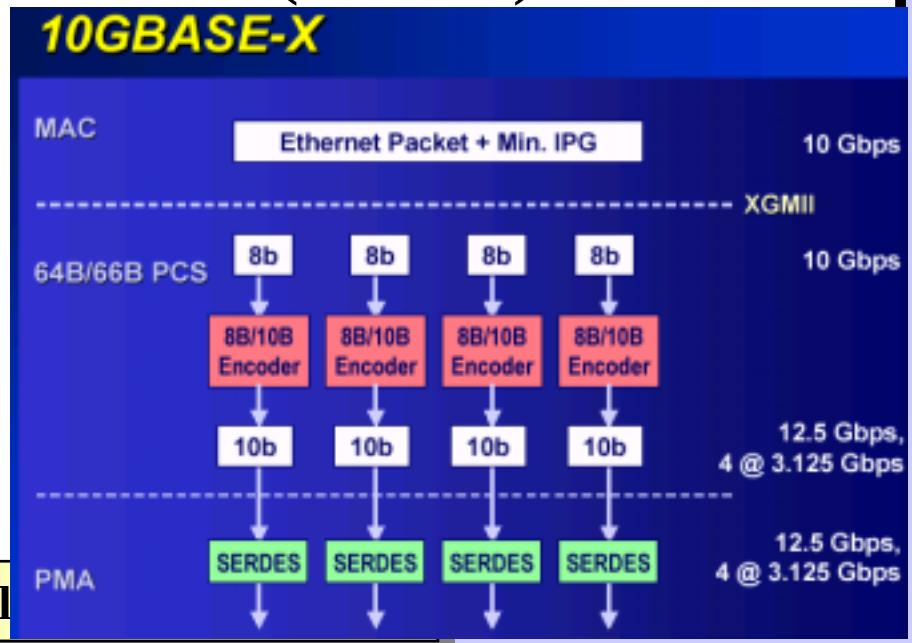
- 802.3ah “Last Mile” stigma
- point-to-multipoint on optical
- Variable data rate MAC
- Fiber to the Home (FTTH)
  - more than 15 years away
  - Cost effective for Green Field
- Regulatory issues
  - ILECs don’t know the rules. Stalling
  - Customers don’t know what they want



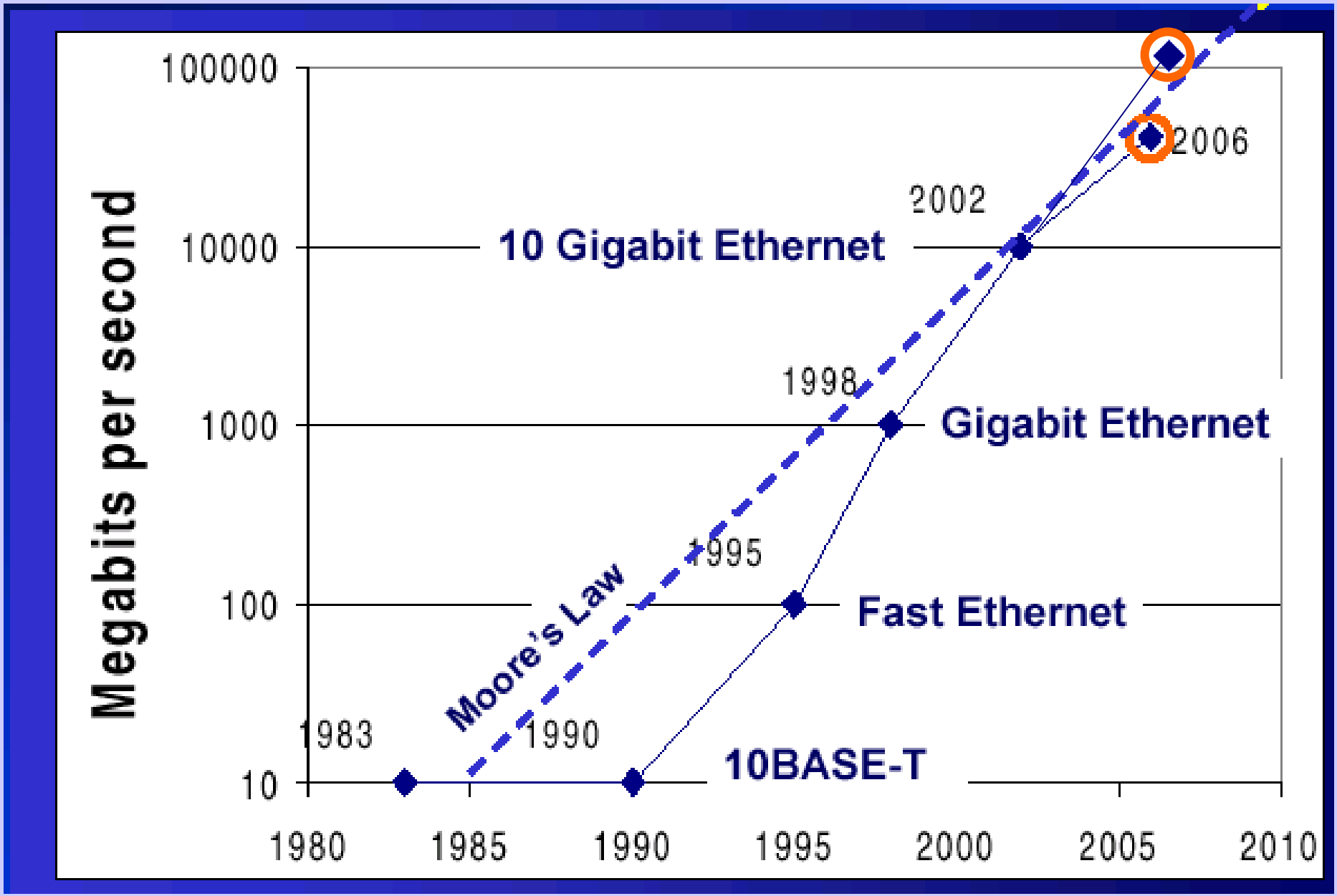
Ethernet Changes

- Powering devices over UTP-5
- Variable data rate MAC 9.5-10.3 Mbps
- Embedded BERT
- Differential, multi-lane bus (XAUI)





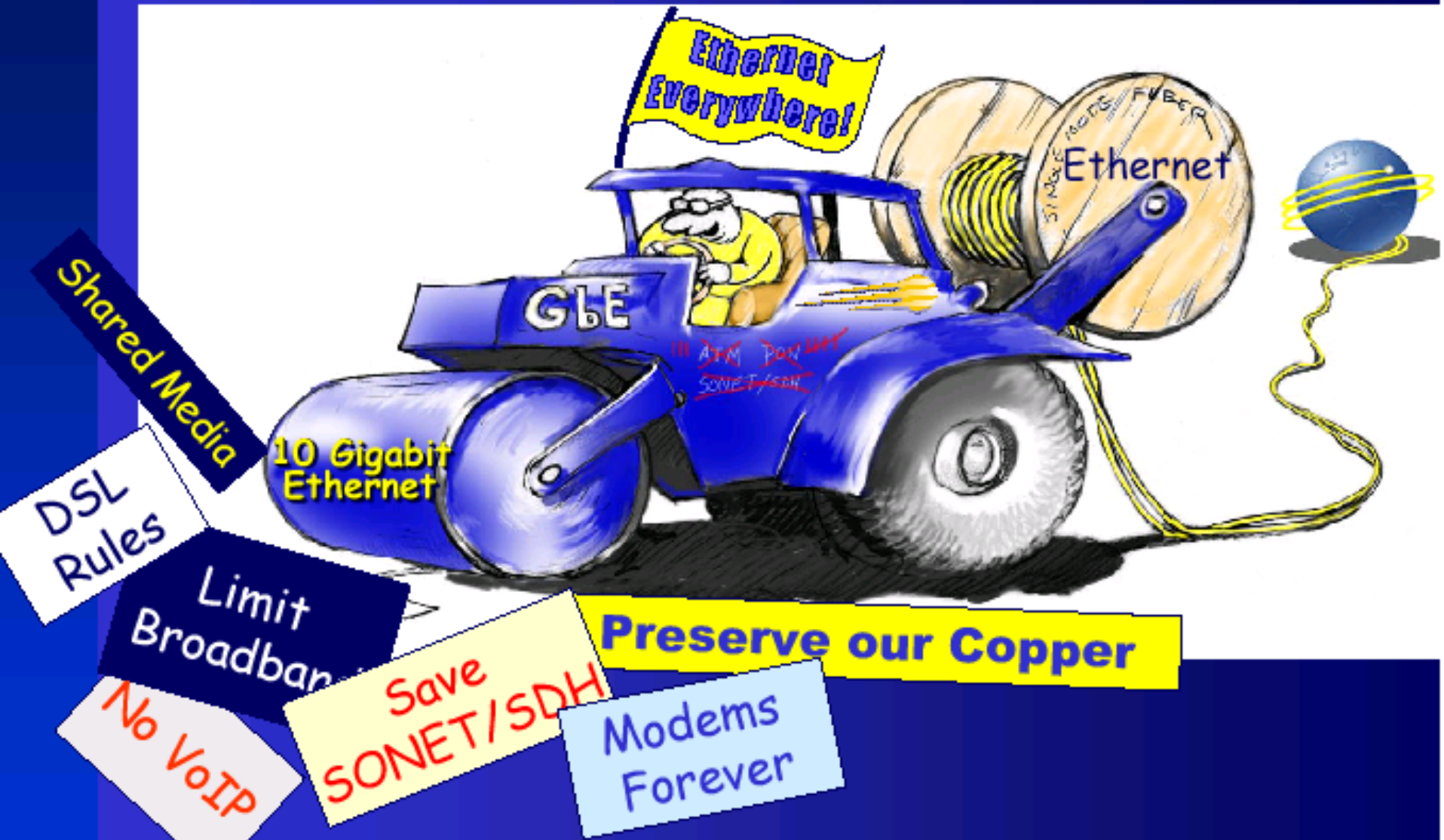
What's after 10Gbps?



After 10GbE

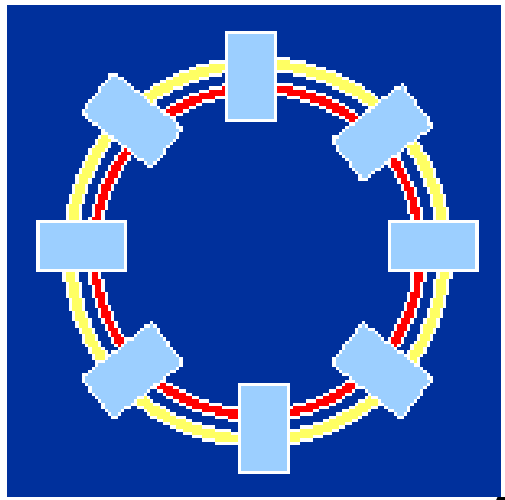
- 1 GbE borrowed from fiber channel
- 10 GbE borrowed from SONET technology
- 40 GbE can be done two ways
  - 10 Gbps with 4 color WDM
  - or OC-768
- 100 GbE has no established technology to draw from

Resistance Is Futile



802.17 Resilient Packet Ring

- Dual counter-rotating rings
- <50ms restoration for failures
- Bandwidth management algorithm for fair access (not equal)
- 16x better than SONET
  - 2x Dual-ring
  - 2x Shortest-hop routing
  - 4-5x Statistical Multiplexing (?)



MPLS

- Better than ATM…
- Technology in search of a problem
  - Fast forwarding to traffic engineering to optical control plane to VPNs
  - 200 Working groups, 5 RFCs
  - Trying to be Everything to Everyone
- Changes to IP give 90% of MPLS benefits
  - Load Balancing
  - Robust routing for failures

Quality of Service

- DiffServ losing momentum
  - Too complex, not enough gain
- “4x Economic Advantage” Where is it?
- “Don’t need end-to-end QoS.”
  - Use where needed – Step by step
  - No guarantees
- Standards for CoS coming – based on ATM
- Maximum 8 tiers of QoS/CoS
  - How does the Army do Flash override?

No Service vs. Poor Service

- Telephone Networks don't guarantee service
  - Busy signals/circuit signals = CAC
  - September 11th
- Telephone industry's artificial requirements
  - 5-9s Reliability (99.999% up-time)
  - 50ms Re-convergence on backbone
- User's don't care
  - Cell phones: sacrifice quality for convenience
  - VoIP for cost savings

Wireless

- Bluetooth dying. No benefit
  - Superceded by 802.11b
- Public Access Networks
  - Starbucks, Airports, Neighborhoods
- Roaming Calling Cards
- Need Application mobility
- 3G needs new transmitters, more towers.
  - What about 802.11b?
  - IPv6 and 3G will live or die together

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New Protocols

- Routing table problem
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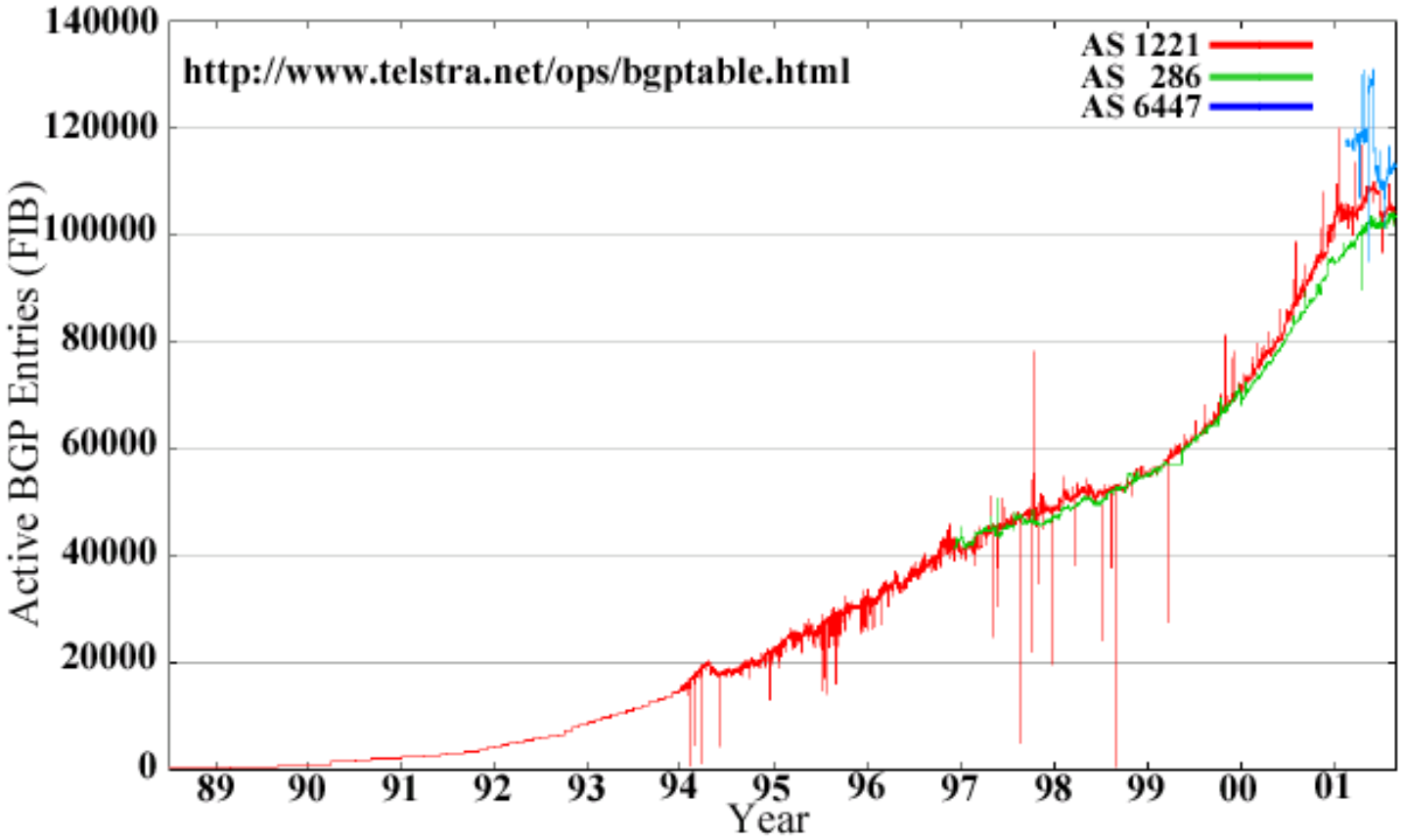

Next Generation Telephony

- IP at the core
  - Qwest to replace all circuit switches in 3-5 years
  - Calling cards are IP
- "Above OC-12, any network can handle high quality with two classes: voice & other"
- More mobile users than Internet by 2004
- RFC-2916
  - Telephone number mapping
  - Return URI, containing SIP proxy, home page, e-mail address, phone/FAX number
  - Privacy Issues

IP version 6

- Will it come? Undecided, but likely
- What problems solved?
  - Security? Same as IPv4
  - QoS? Same as IPv4
  - Addresses? Yes, for Asia & cell phones
  - Routing Problems? Yes
    - Aggregation – both/all routes can be aggregated
    - Disagreement on severity of problem

IPv6 Implementation

- DNS servers already support AAAA records
- Users will not know when implemented
  - Autoconfig will start using IPv6 when available
- Flow Label – disagreement on usefulness
  - Save for later
- IPv6 benefits 3G, palm/phone
  - still many years out
- “When Amazon, Yahoo and the top 10 porn sites are IPv6, the rest will follow.”
- “Waiting on Uncle Bill”

AOL Lessons Learned

- Failures: Digital comics, on-line soaps, 3-D gaming, digital movies, 500-channel Universe
  - "That's really cool…take it out."
  - Relationship: interactive vs. passive
  - Bandwidth constraints: when 10% on broadband, content will change
- Typical user: chat rooms, 7 e-mails/day
  - Computer illiterate
- "Our competition is TV & life, 7-12pm."

Revolutionary vs. Evolutionary

- 8x growth over "Moore's Law"
  - SONET 4x/year
  - DWDM 2x/year
- VoIP
  - 80-300% growth
  - More mobile users than wired by 2004
- Bandwidth glut:

  Waste bandwidth to save CPU cycles

- Start-ups gone, few IPOs
- No revolutionary innovators
- Bandwidth glut:

  Nortel 1/2 –size, Corning shutting factory for 3 mos.

- Invest in companies with staying power

Reflection on Change

- It will take a long time, possibly never, to change the Internet
  - IPv6
  - Multicast
  - QoS
  - 3G

Open Discussion